

## **REMARKS/ARGUMENTS**

### **(1) Summary of Office Action**

In the Office Action dated April 17, 2006, the Examiner objected to claim 21 because of an incorrect dependency. Claim 21 was dependent on claim 18, when actually it should have been dependent on claim 20.

In addition, Claims 1 to 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable in light of the combined teachings of two or more of the following patent references: European Patent No. 0 497 214 of Fattinger; United States Patent No. 6,358,729 of Ferranti ; United States Patent No. 5,876,606 of Blowes et al.; United States Patent No. 6,291,233 of Saha et al.; United States Patent No. 5,837,142 of Mullerheim; and United States Publication No. 2002/0170858 of Maddux et al.

### **(2) Amendments to the Specification**

Paragraph [0040] has been amended to delete certain examples of materials suitable for use in the hydrophilic nucleus.

### **(3) Claim Amendments**

The applicant has cancelled claims 1 to 19, amended claims 20 and 21 and added new claims 26 to 81. Claims 22 to 25 were withdrawn from the subject application in the applicant's reply dated March 10, 2006.

Claims 20 to 21 were amended to include the term "gas-phase" in the preamble. The inclusion of this term in the preamble makes explicit the fact that these claims are directed to a gas-phase biofilter system. This was implicit in the originally-filed claims 20 and 21 as these claims contained references to "contaminated air" and "cleaned air".

New claims 26 to 47 are directed toward a method of removing odour causing compounds from waste gas. The limitations recited in the newly added claims correspond substantially to those of cancelled claims 1 to 19.

New claims 48 to 81 ultimately depend from claim 20 and recite additional features of the gas-phase biofilter system.

With the deletion of claims 1 to 19, the Examiner's rejections of these claims are now considered to be moot and accordingly, need not be addressed. Below, the applicant makes submissions as to why amended claims 20 and 21 and new claims 26 to 81 are patentable over the cited prior art.

## **Claim 20**

Claim 20 as amended is an independent claim directed toward a gas-phase biofilter system. The claimed system includes a biofilter media which has a porous hydrophilic nucleus and a hydrophobic coating on the hydrophilic nucleus. The hydrophobic coating includes a metallic agent, microorganisms, nutrients, an organic carbon source, an alkaline buffer, a bonding agent, an adsorptive agent and a hydrophobic agent.

The applicant respectfully submits that amended claim 20 is patentable over the prior art references cited by the Examiner, whether taken alone or in combination. In particular, it is the applicant's view that there is no motivation or suggestion to combine Fattinger, Blowes et al. and Ferranti in the manner suggested by the Examiner. In support of its view, the applicant wishes to bring to the Examiner's attention the following comments in respect of the prior art references.

### **European Patent Application No. 0 497 214 of Fattinger**

Fattinger teaches a method of purifying exhaust air using granular material composed of a porous hydrophilic material coated with a hydrophobic layer. The hydrophobic layer is made from activated charcoal or adsorption resin. In contrast to the biofilter media recited in claim 20 where the microorganisms are part of the hydrophobic layer, in the biofilter material described by Fattinger microorganisms are found in the pores of the hydrophilic grains (see page 2, fifth and eighth paragraphs of the English translation). Fattinger neither teaches nor suggests the inclusion of a metallic agent in its hydrophobic layer.

### **United States Patent No. 6,358,729 of Ferranti**

Ferranti describes a compact plant for the depuration treatment of air polluted by odorous substances. The compact plant includes a filtering bed that consists of filtering material as described in Fattinger (see column 4, lines 20 to 24). Ferranti teaches that the compact plant may be used to remove hydrogen sulphide.

### **United States Patent No. 5,876,606 of Blowes et al.**

Blowes et al. discloses an apparatus and procedure for treating waste water contaminated with phosphorus. The treatment material employed by Blowes et al. contains grains of sand, or other relatively-large particles which are coated with powder-fine particles of metal oxide (see column 3, lines 1 to 3). In the treatment process of Blowes et al., the concentration of phosphorus dissolved in the waste water is lowered by converting the dissolved phosphorus into solid form either through precipitation or adsorption reactions involving the metal oxide particles (see column 2, lines 15 to 24).

### **United States Published Patent Application No. 2002/01700588 of Maddux et al.**

Maddux et al. discloses a system and method for removing contaminants, such as ferrous iron, manganese and sulfide, from groundwater that has a relatively low oxygenation content and

that is contaminated with ferrous iron, manganese, sulfide and other contaminants (see Abstract). The waste water to be treated is inoculated with bacteria. The system has biofiltration media consisting of a plurality of plastic bio-media balls. The bio-media balls provide a surface for the bacteria to adhere to and propagate. The method of Maddux et al. uses bacterial oxidation to transform ferrous iron to ferric iron. In the ferric state, the iron readily combines with carbonates and sulfur in the waste water to form precipitates which settle on the surfaces of the bio-media balls (see paragraph 30).

### **Blowes et al. is Non-Analogous Art**

On page 11 of the Office Action dated April 17, 2006, the Examiner states: "Fattinger, Blowes and Ferranti are analogous art because they are from the same field of endeavour regarding fluid treatment filtration processes." The applicant respectfully disagrees with this proposition. While it can be said that Fattinger and Ferranti are analogous art as both patents describe systems and/or methods for the treatment of contaminated air, the same cannot be said of Blowes et al. Blowes et al. does not fall within the same technical field as Fattinger and Ferranti.

The invention of Blowes et al. simply does not relate to the treatment of contaminated air. The techniques and systems for treating waste water are significantly different than those employed to treat contaminated air such that they cannot be considered to be analogous art. More specifically, while the waste water treatment system of Blowes et al. utilizes chemical precipitation and adsorption to remove phosphorus from the waste water, Fattinger and Ferranti use the biological activity of microorganisms to break down the Volatile Organic Compounds (VOCs) and hydrogen sulphide found in the contaminated air. Functionally speaking, these mechanisms are every different. Moreover, it should also be noted that Blowes et al. is concerned with the removal of phosphorus not VOCs or hydrogen sulphide.

The applicant draws additional support for its contention that Blowes et al. is non-analogous art from the U.S. classification of the various cited references. The invention of Blowes et al. was classified under U.S. Class 210 which relates to patents directed to treating water or waste liquid, including processes and apparatus for purifying waste water and filter materials or compositions peculiar to such processes. In contradistinction, Ferranti was classified in U.S. Classes 435 (relating to processes for treating a material with a microorganism to purify a preexisting substance) and 55 (relating to gas separation apparatus).

### **No Motivation to Combine Blowes et al. with Fattinger and/or Ferranti**

A person skilled in the art would not have combined Fattinger and Ferranti with Blowes et al. to arrive at the claimed invention for the reasons set out below.

First, given the technical differences that exist between waste water treatments and waste air treatments, a person skilled in the art would not be inclined to consider a patent reference offering a technical solution for the removal of phosphorus from waste water when what was actually being sought was a solution for removing odour causing compounds from contaminated air.

Second, contrary to the Examiner's contention, none of the references describe nor suggest a motivation for combining the references as suggested by the Examiner. At column 5, lines 26 to 32, the disclosure of Blowes et al. states:

"In FIG. 5, an in-line system comprising a modular unit is used to treat domestic waste water before final discharge to the infiltration bed. This arrangement is suited to water treatment systems that produce a high quality effluent from recirculating sand filters, biofilters, aerobic treatment systems, and the like."  
[underline added for emphasis]

The Examiner appears to have taken these statements as a motivation for the proposed combination. However, the biofilters referred to in the afore-mentioned statements of Blowes et al. are liquid-phase biofilters used to treat waste water, not the gas-phase biofilters described in Ferranti and Fattinger. An indication that the system of Blowes et al. would be suitable for waste water treatment systems employing biofilters does not mean that such a system would be suitable for use in gas-phase biofilters used to decontaminate waste air.

Third, in Blowes et al. the metal oxide is involved in the chemical precipitation and adsorption reactions which reduce the concentration of phosphorus in the waste water. The metal oxide also serves as a catalyst to increase the rate at which organic phosphorus molecules are hydrolysed to an inorganic form. Neither Fattinger nor Ferranti deal with the removal of phosphorus. Moreover, there is no teaching or suggestion in any of the cited references that the addition of metallic agent would serve any beneficial purpose in a gas-phase biofilter employed in treatment of waste air contaminated with odour causing compounds. The applicant has found no support in any of the references for the Examiner's contention that the iron powder coating of Blowes would be beneficial if used in the invention disclosed by Fattinger.

Fourth, the Examiner is of the view that the metal coating layer of Blowes as applied to the granular material of Fattinger would work to remove contaminants that are not eliminated by microbial degradation by precipitating them on the surface of the grain. The applicant respectfully submits that, if this statement were true, it would actually be a disincentive for the proposed combination.

The metallic agent in the biofilter media of the claimed invention not only allows the removal of sulphur by the formation of iron sulfide, but also serves to enhance the conversion and biological processing of sulfur compounds in the contaminated air. Moreover, without the presence of iron or metallic components, biological oxidation of sulfur compounds may lead to elemental sulfur deposits on the biofilter media (see paragraph [0049] of the subject application). It would not be desirable to break down the odour causing sulphur compounds to form a precipitate of elemental sulphur which would settle on the biofilter media and have the effect of reducing its life cycle. A person skilled in the art of gas-phase biofilters would not be motivated to add a metallic agent to the biofilter media of Fattinger or Ferranti to cause a precipitate to collect on the biofilter media ultimately impeding its proper functioning.

The fact that the metallic agent in the gas-phase biofilter media of the claimed invention actually acts as catalyst to increase the rate of biological oxidation and enhance the activity of the microorganisms is a wholly unexpected benefit discovered by the named inventors - one that is neither taught nor suggested in any of the cited references.

### **Maddux et. al. is Non-Analogous Art**

On page 13 of the Office Action dated April 17, 2006, the Examiner states: "Fattinger and Maddux are analogous art because they are from the same field of endeavour regarding filters for fluid treatment processes." The applicant respectfully disagrees with this proposition. Maddux et al. does not fall within the same technical field as Fattinger.

The invention of Maddux et al. simply does not relate to the treatment of contaminated air. The techniques and systems for treating waste water are significantly different than those employed to treat contaminated air such that they cannot be considered to be analogous art. Functionally speaking, these mechanisms are every different. Maddux et al. is concerned with finding a technical solution for removing contaminants in groundwater, not treating contaminated air.

### **No Motivation to Combine Maddux et al. with Fattinger**

A person skilled in the art would not have combined Fattinger with Maddux et al. to arrive at the claimed invention for the reasons set out below.

First, given the technical differences that exist between waste water treatments and waste air treatments, a person skilled in the art would not be inclined to consider a patent reference offering a technical solution for the removal contaminants from groundwater having a relatively low oxygen content, when what was actually being sought was a solution for removing odour causing compounds from contaminated air.

Second, Maddux et al.'s invention is concerned with removing iron and other contaminants from groundwater. In stark contrast to Maddux et al., the metallic agent in the claimed invention is not a contaminant, but a useful additive to assist in the biological oxidation reactions employed to break down odour causing compounds.

Third, because of the differences in the fluid to be treated, the iron in Maddux et al.'s invention serves a different function than that of the metallic agent in the biofilter media in the claimed invention. In Maddux et al.'s invention, bacterial oxidation transforms ferrous iron to ferric iron. In the ferric state, the iron readily combines with carbonates and sulfur in the waste water to form precipitates thereby removing the contaminants from the waste water. Conversely, in the claimed invention, the presence of a metallic agent serves as a chemical reactant to convert sulfur gases to mineral salts during operation of the gas-phase biofilter.

Fourth and perhaps most importantly, when iron is used as the metallic agent in the biofilter

media of the claimed invention, iron sulfide (FeS) is formed. In this compound, the iron is in its Iron (II) oxidation state,  $\text{Fe}^{2+}$ , also known as the "ferrous" state. The formation of iron sulfide is desired in the claimed invention because it results in the removal of sulphur from the contaminated air. This is not the case in Maddux et al. where, when in its ferrous state, the iron is actually considered to be an undesirable contaminant which requires bacterial oxidation for conversion into ferric iron.

In light of the foregoing, the applicant respectfully submits that the teachings of Maddux et al. would actually provide a disincentive for combining iron to the biofilter media of Fattinger.

### **Claim 21**

Amended claim 21 depends from claim 20 and is directed toward an additional feature of the claimed biofilter system. Insofar as claim 20 is presently allowable over the cited prior art, the applicant respectfully submits that claim 21 is also allowable.

### **New Claims 48 to 81**

New claims 48 to 81 ultimately depend from claim 20 and are directed toward additional features of the claimed biofilter system. Insofar as claim 20 is presently allowable over the cited prior art, the applicant respectfully submits that claims 48 to 81 also allowable.

### **Claim 26**

New claim 26 is an independent claim directed toward a method of removing odour causing compounds from waste gas. The method includes urging waste gas to flow through a gas-phase biofilter having a biofilter media. The biofilter media includes a plurality of grains. Each grain has a porous hydrophilic nucleus and a hydrophobic coating on the hydrophilic nucleus. The hydrophobic coating includes a metallic agent, microorganisms, nutrients, organic carbon, an alkaline buffer, a bonding agent, an adsorptive agent and a hydrophobic agent.

The applicant respectfully submits that new claim 26 is patentable over the prior art references cited by the Examiner, whether taken alone or in combination in view of the applicant submissions set forth above in respect of claim 20.

### **Claims 27 to 47**

New claims 27 to 47 ultimately depend from claim 26 and are directed toward additional features of the claimed method. Insofar as claim 26 is presently allowable over the cited prior art, the applicant respectfully submits that claims 27 to 47 are also allowable.


(4) **Conclusion**

The present amendment imports no new subject matter into the application.

Consideration of the above-identified application is respectfully requested. If after reviewing this amendment, the Examiner believes that a telephone or personal interview would facilitate the resolution of any remaining matters, the undersigned attorney may be contacted at the number set forth herein below.

Respectfully submitted,

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Date

  
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